

**Milford Lake  
1999 Water Quality Report**

**1. General.**

- a. **Project location.** Milford Dam is located approximately 5 miles northwest of Junction City, Kansas, at river mile 7.7 on the Republican River, a tributary of the Kansas River. The project watershed encompasses 3,852 square miles and extends to the Harlan County Dam in south-central Nebraska.
- b. **Authorized project purposes.** Flood control and water supply are the primary project purposes; equally important, however, are its fish and wildlife resources and recreation benefits.
- c. **Pertinent data.**

Pools	Surface Elevation (ft. above m.s.l.)	Current Capacity (1,000 A.F.)	Surface Area (acres)	Shoreline (miles)
Flood Control	1,176.2	752.9	33,000	
Multipurpose	1,144.4	372.3*	16,000	163
Inactive		112.1**		
Total		1,125.2		

Total Drainage Area: 24,880 sq. miles

Average Annual Inflow: 777,708 acre-feet

\* Based on the most recent hydrographic survey

\*\* Contained in multipurpose pool

**2. Activities and studies of the year.**

Monthly herbicide and nutrient sampling was conducted by lake project personnel, with technical and analytical support from PM-PR-W, April-September 1999 at one inflow station, three lake stations (two depths), and the outlet. Nutrient samples were shipped to the Chemical and Materials Quality Assurance Laboratory (CMQAL) in Omaha for analysis, while the herbicide samples were shipped to the PM-PR-W laboratory for analysis of four of the most commonly occurring herbicides by the ELISA (enzyme linked immunosorbent assay) method. Ten percent of the herbicide samples were shipped to the CMQAL to be analyzed by GC (Gas Chromatography) for quality control purposes. All generated data were entered in excel spreadsheets as an interim to the EPA national water quality data management system, NEW

STORET, which is still in the developmental stage. Table 1 at the end of this report includes all the available nutrient and herbicide data for the past years from 1996-1999.

The OF-MI is to be commended for its continued support of water quality monitoring of Milford Lake and its tributaries. The OF-MI personnel deserving special recognition include Messrs. Harvey Brink, Brent Logan, Craig Chamberlin, and Bradley Myers.

### 3. Existing conditions.

FIGURE 1: MI-24

#### a. Inflow.

The Republican River south of Clay Center, Kansas, was sampled monthly from April-September 1999. The average total nitrogen (i.e.,  $\text{NH}_3 + \text{NO}_2 + \text{NO}_3 + \text{TKN}$ ) concentration was well above eutrophic levels ( $> 1 \text{ mg/L}$ ) at  $1.93 \text{ mg/L}$ ,

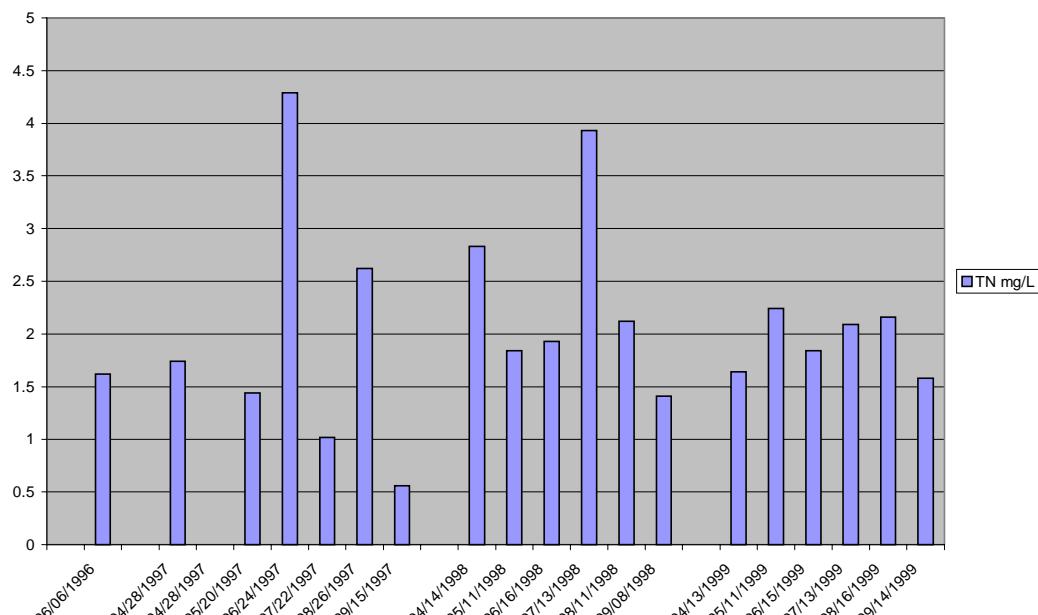
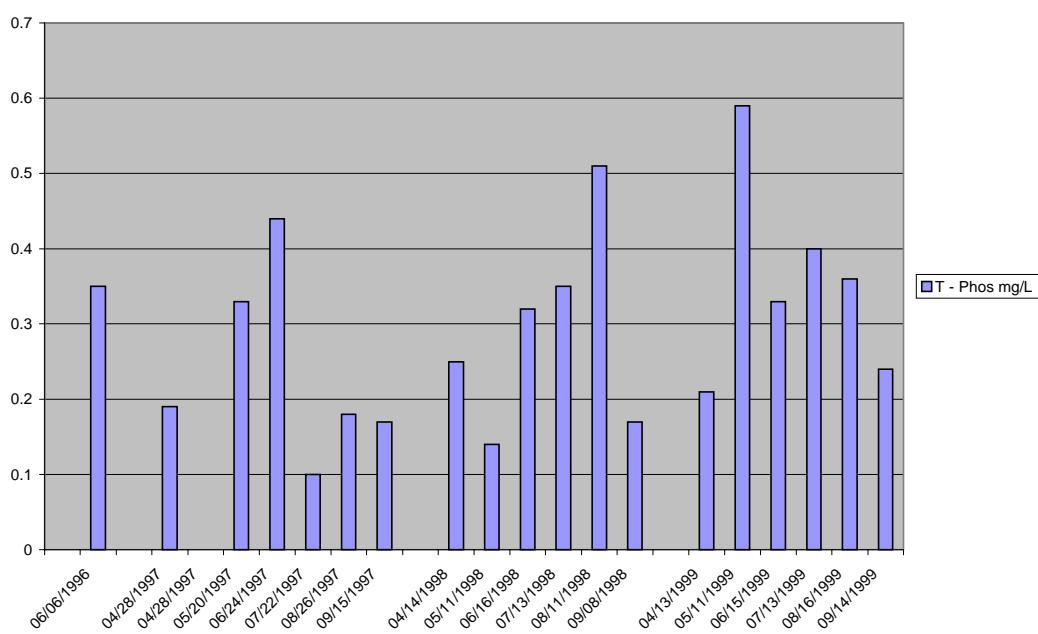


FIGURE 2: MI-24



above eutrophic levels with spikes occurring during high inflows such as May 1999. The total phosphorus (TP) mean concentration, 0.36 mg/L, also remains above the Environmental Protection Agency (EPA) suggested stream criterion of 0.1 mg/L for the protection of aquatic ecosystems. The stream has been characterized by hypereutrophic phosphorus levels over the period of record (figure 2).

Within the six-month sampling period of April-September for herbicides, atrazine

and metolachlor were the most prevalent. The mean and maximum for atrazine were 1.59 ug/L and 3.35 ug/L, respectively. The June runoff was above the EPA maximum contaminant level (MCL) standard for drinking water

supplies of 3 ug/L. The trend for the past four years is shown in figure 3. The mean and maximum for metolachlor were 0.56 ug/L and

1.69 ug/L, respectively. Cyanazine and alachlor were detected in smaller quantities and were well below the suggested EPA standard for drinking water of 1 ug/L and 2 ug/L, respectively. Atrazine exceeded the

FIGURE 3: MI-24

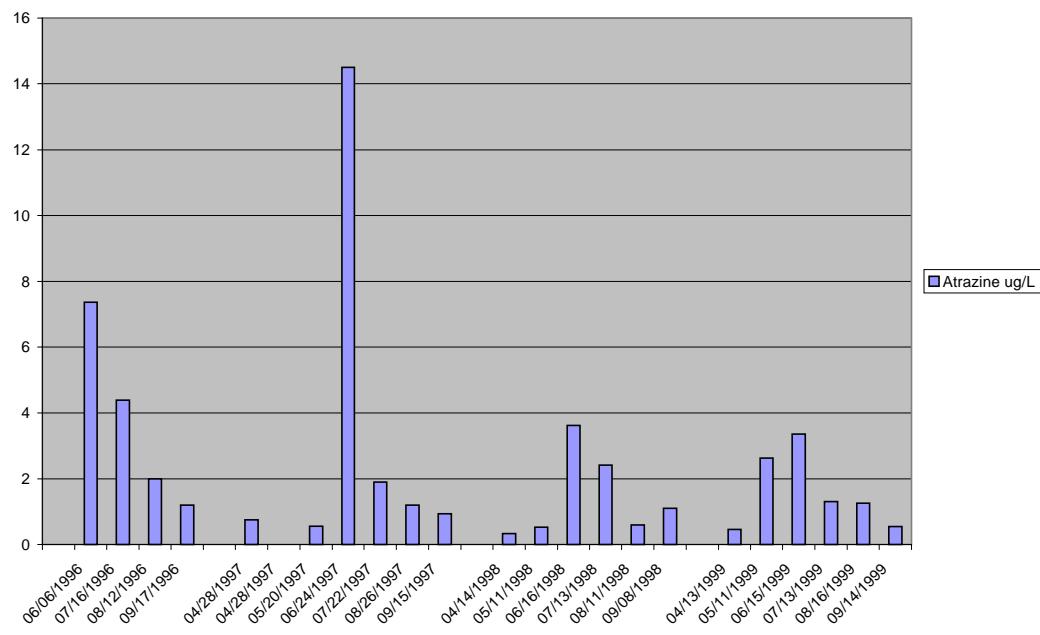
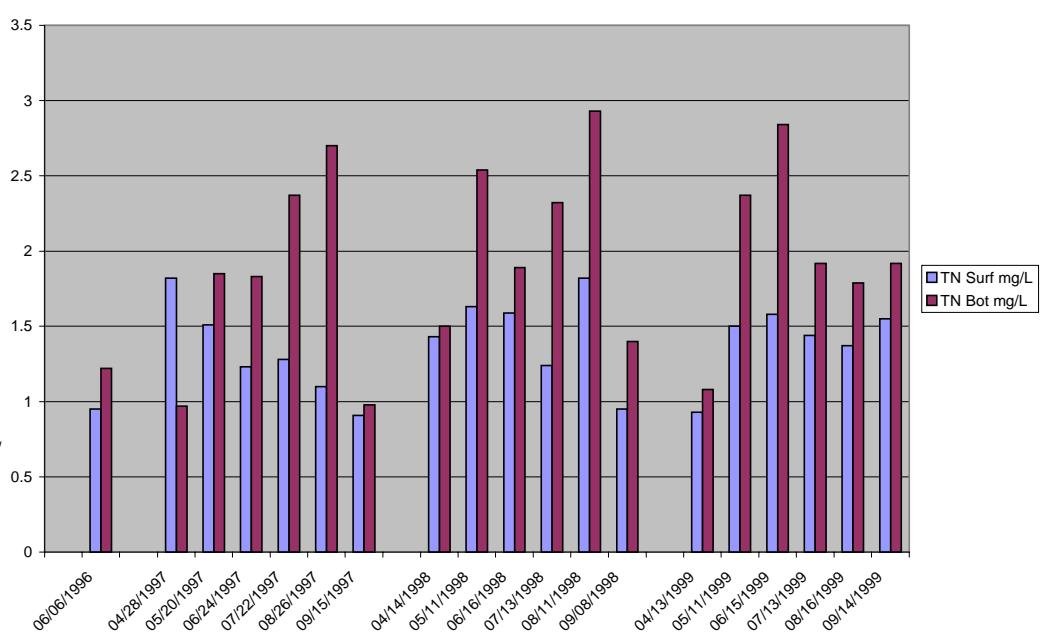


FIGURE 4: MI-1



EPA standard of 1 ug/L for the protection of aquatic ecosystems in 67% of the 1999 samples. To date the EPA has not set standards for metolachlor.

b. **Lake.** The three stations sampled during the six-month sampling period were downlake near the dam (station MI-1), midlake (station MI-3), and the upper lake area near the Highway 82 Bridge (station MI-5). As can be seen in

figures 4, 5, and 6, nutrient concentrations were typical of the impoundment over the period of record. These three graphs show the relationship between surface and bottom concentrations for the past three years. Concentrations within

the water column appear to

be fairly

uniform.

The high

spikes can

be attributed

to high

inflows

and

temperature

differences

between

surface

and

bottom

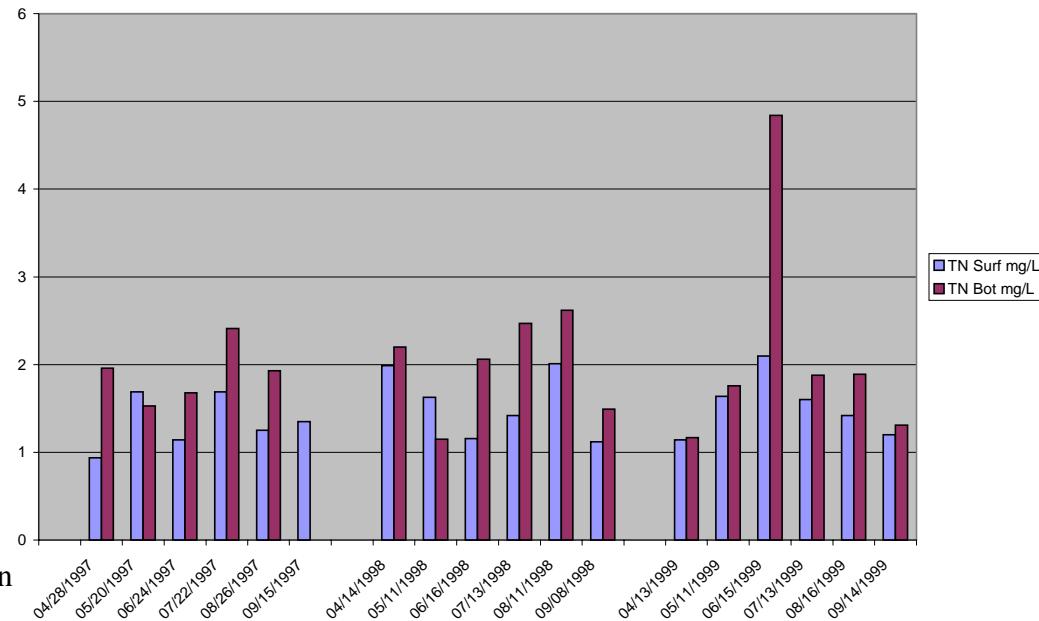
waters.

The 1999

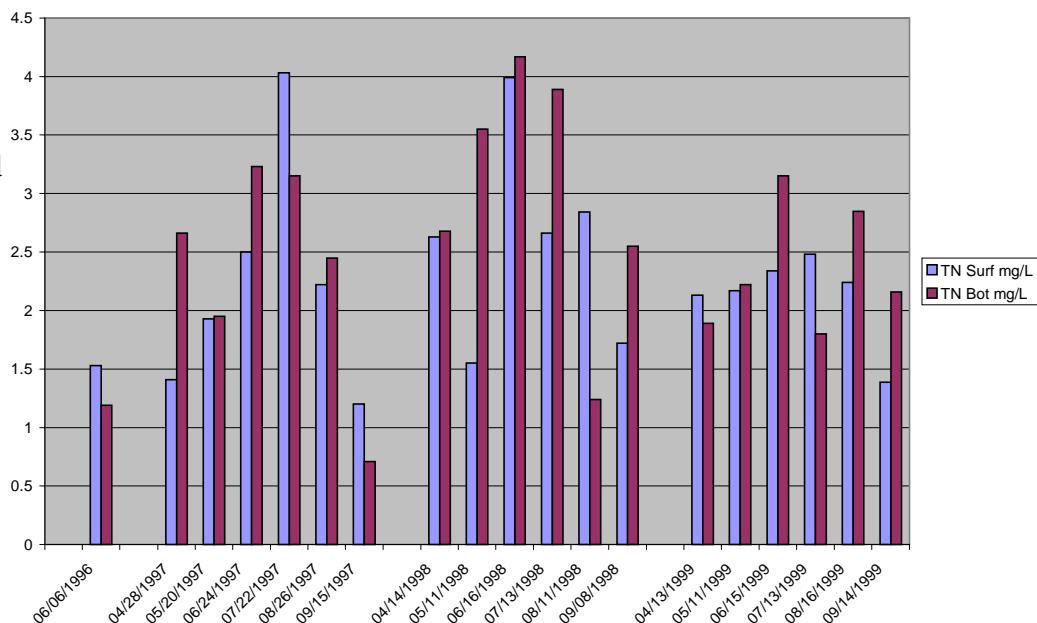
mean and

maximum total nitrogen concentrations in the surface waters were 1.40 mg/L and 1.58 mg/L,

**FIGURE 5: MI-3**



**FIGURE 6: MI-5**



respectively, at MI-1, 1.52 mg/L and 2.10 mg/L, respectively, at MI-3, and 2.13

mg/L and 2.48 mg/L, respectively, at MI-5. Mean and maximum total nitrogen concentrations in the bottom waters were higher at 1.99 mg/L and 2.84 mg/L, respectively, at MI-1, 2.14 mg/L and 4.84 mg/L, respectively, at MI-3, and 2.35 mg/L and 3.15

mg/L, respectively, at MI-5. Total phosphorus concentrations contributed to the eutrophic nature of the lake with mean and maximum concentrations in the surface waters of 0.21 mg/L and 0.47 mg/L, respectively, at MI-1, 0.22 mg/L and 0.4 mg/L, respectively, at MI-3, and 0.38 mg/L and 0.57 mg/L, respectively at MI-5. Mean total phosphorus concentrations in the bottom waters were fairly consistent with the concentration in the surface waters. The ratios of total nitrogen to total phosphorus in each section of the reservoir indicate phosphorus is the

limiting nutrient.

Figures 7, 8, and 9 show

concentrations at the surface and bottom depths throughout the lake from 1996-1999.

Total phosphorus concentrations tend to follow the same

pattern as the total nitrogen concentrations, fairly uniform throughout the lake. These nutrient levels continue to be within moderate to highly eutrophic ranges.

FIGURE 7: MI-1

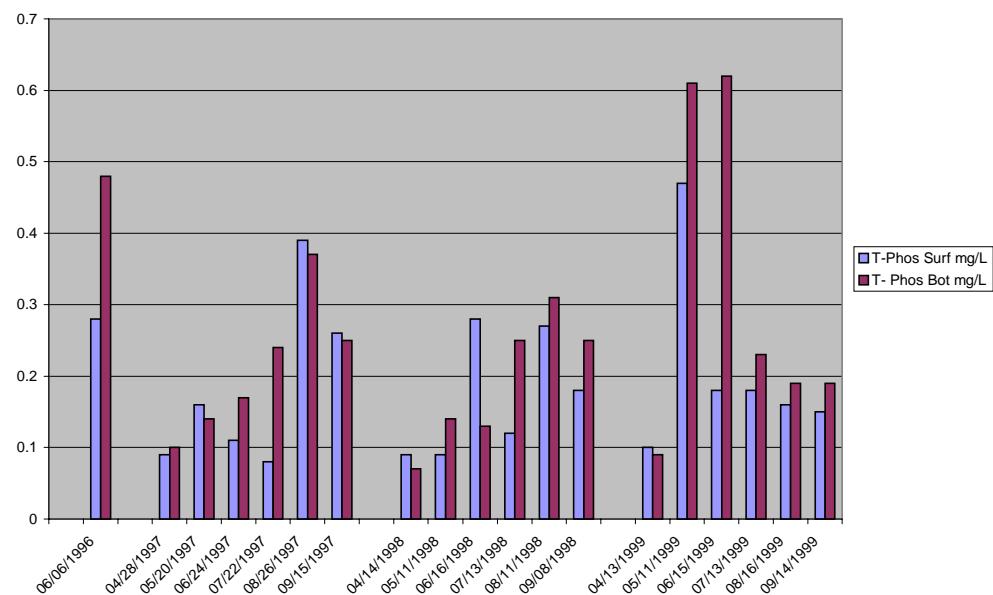
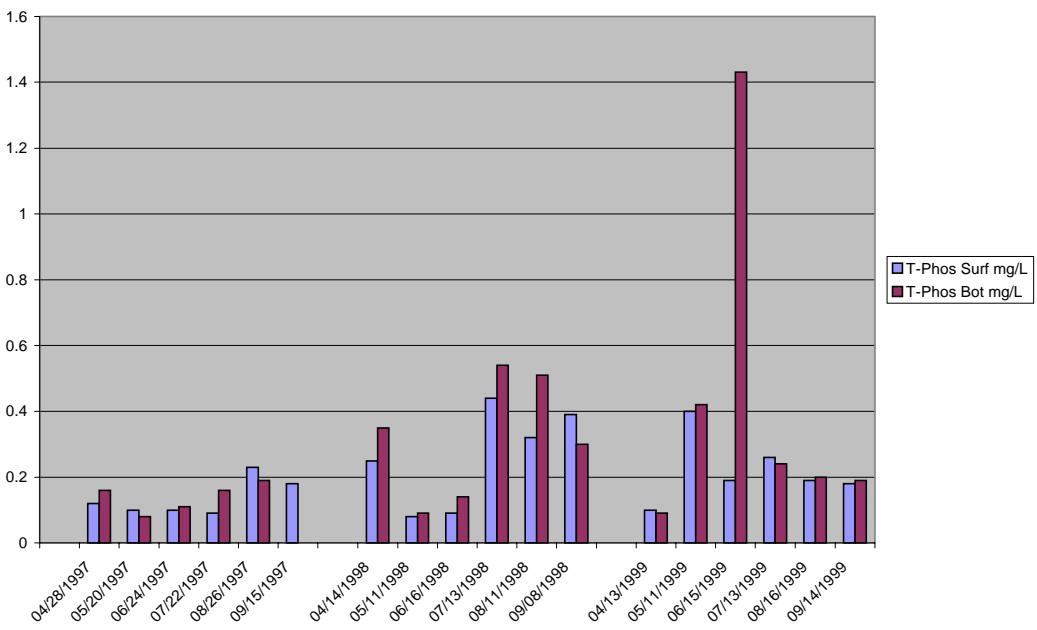
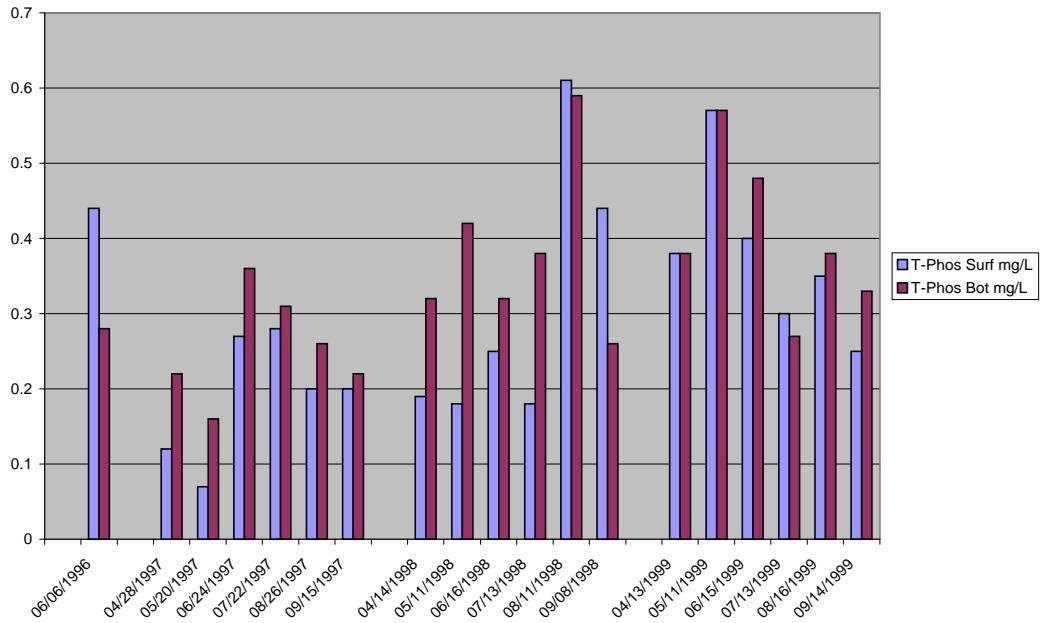


FIGURE 8: MI-3



**FIGURE 9: MI-5**

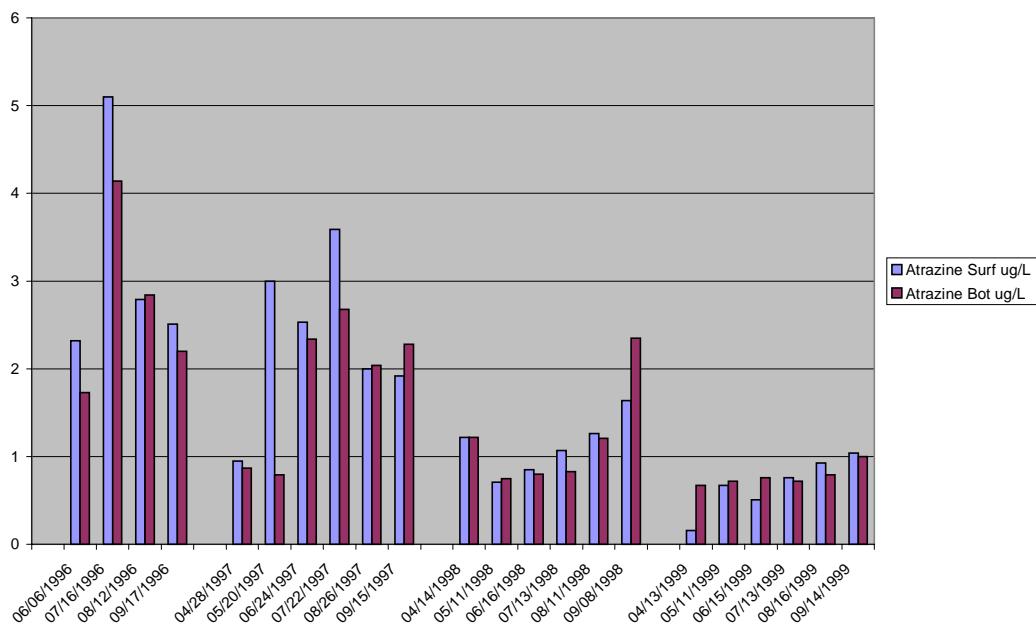


In the monthly surveys during April-September, the four herbicides (atrazine, metolachlor, alachlor, and cyanazine) were detected. Higher concentrations of atrazine were apparent in the uplake area during the spring run-off period of

May and June with concentrations decreasing as the herbicide moved through the lake. Atrazine was detected in 100% of the 1999 samples. Concentrations of atrazine exceeding the MCL of 3 ug/L occurred in only 11% of the samples.

The mean and maximum atrazine concentrations in the surface waters of the lake were as follows, 0.68 ug/L and 1.04 ug/L (MI-1); 0.84 ug/L and 1.28 ug/L (MI-3); and 1.73 ug/L

**FIGURE 10: MI-1**



and 3.20 ug/L (MI-5), respectively. Bottom mean and maximum atrazine

concentrations for the above areas were 0.78 ug/L and

1.00 ug/L; 0.88 ug/L and 1.20 ug/L; and 1.86 ug/L and 3.46 ug/L, respectively. Figures 10, 11, and 12 show the trend for atrazine for the years 1996-1999. As can be seen from these graphs, high concentrations occur throughout the lake in early spring during the high run-off periods and then level off. For the most part concentrations are uniform throughout the water column.

Metolachlor was detected in all but one of the

1999 samples. The mean and maximum metolachlor

FIGURE 11: MI-3

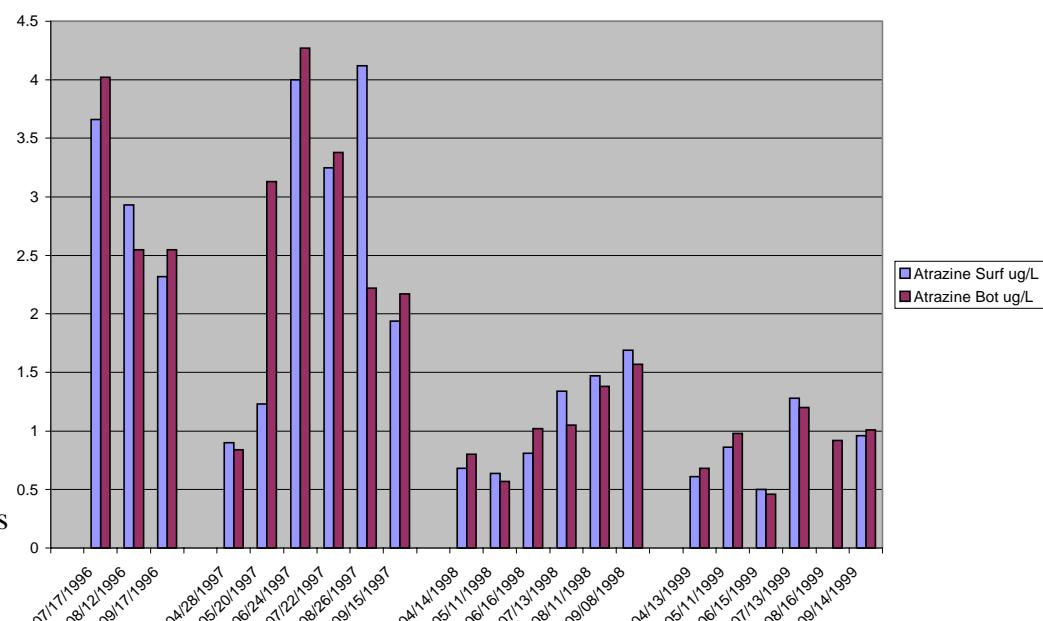
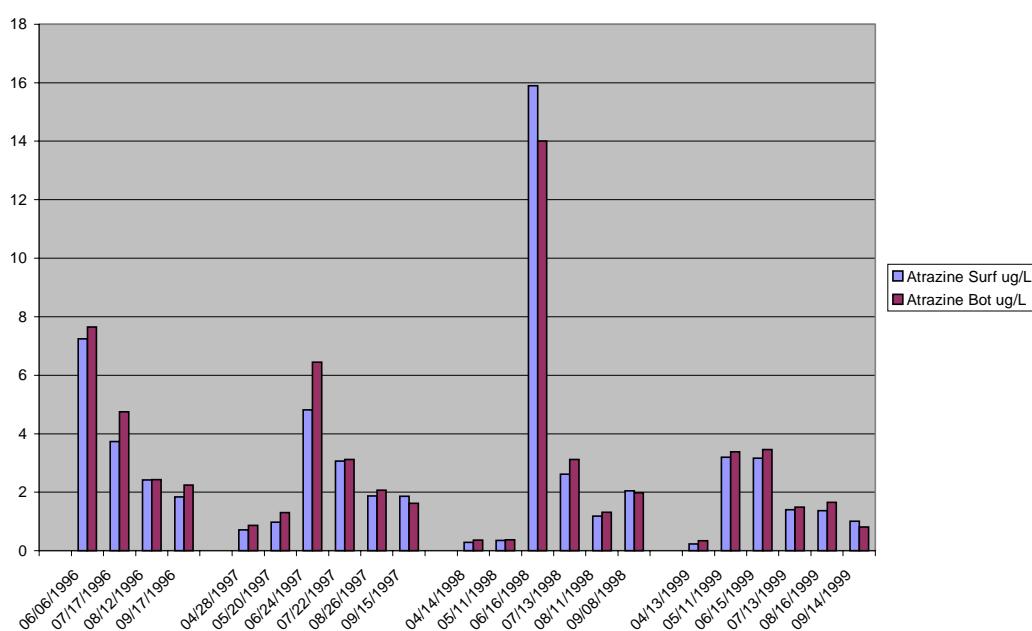


FIGURE 12: MI-5



concentrations in the surface waters were as follows, 2.11 ug/L and 3.05 ug/L (MI-1); 1.80 ug/L and 3.36 ug/L (MI-3); and 1.91 ug/L and 4.51 ug/L (MI-5), respectively. Bottom mean and maximum concentrations for the above areas were 1.43 ug/L and 2.84 ug/L; 1.68 ug/L and 3.01

ug/L; and 1.75 ug/L and 4.61 ug/L, respectively. Although detected in about 80% of the 1999 samples, neither alachlor nor cyanazine exceeded established criteria.

c. **Outflow.** The present sampling indicated the water quality conditions in the outlet (MI-1A) continue to be satisfactory. The

nutrient levels remained moderately to highly enriched with mean total nitrogen and total phosphorus concentrations of 1.48 mg/L and 0.22 mg/L, respectively. Again, as shown in figures 13, and 14,

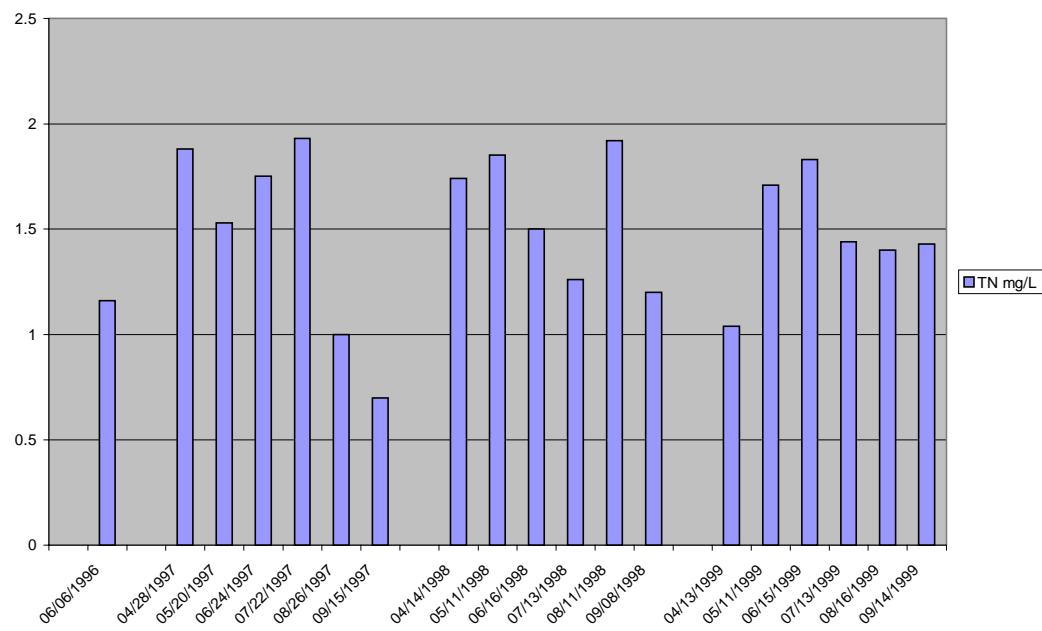
concentrations are higher during the high run-off periods. The mean and maximum concentrations for atrazine were 0.76 ug/L and 0.95 ug/L, respectively, for the 1999 survey periods. None of the samples exceeded the MCL of 3 ug/L for atrazine. Figure 15 shows the trend for the years 1996-1999.

As can be seen from this graph, there was a

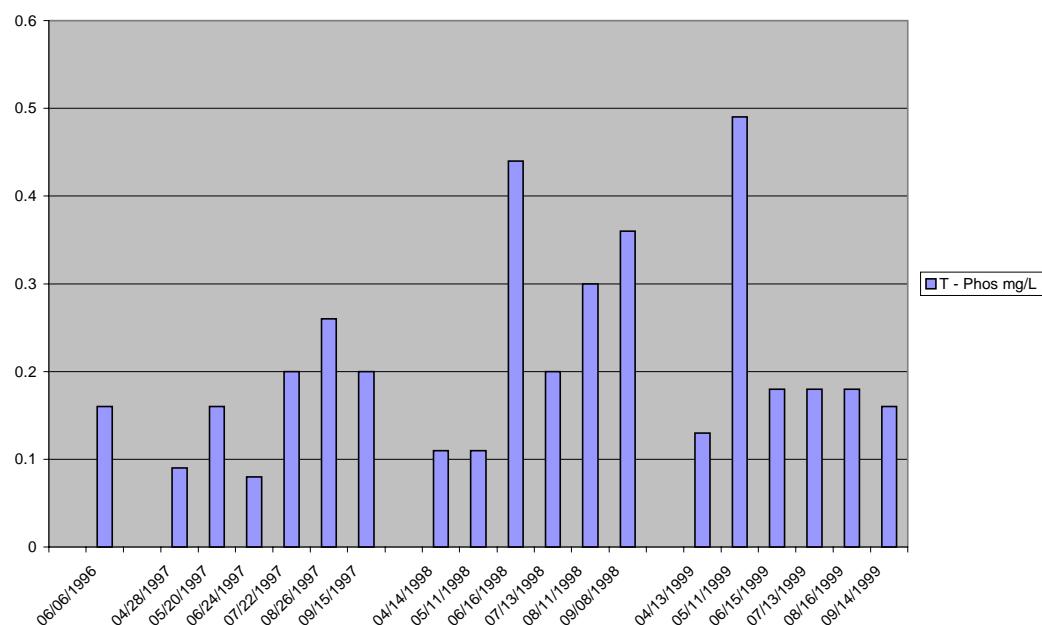
decrease in the outlet in 1999 compared to previous years. The mean and maximum

concentrations for metolachlor were 1.62 ug/L and 3.16 ug/L,

**FIGURE 13: MI-1A**



**FIGURE 14: MI-1A**



respectively. Although detected in 67% of the 1999 samples,

neither alachlor nor cyanazine exceeded established criteria. The results of the monthly surveys from June-September do not support past findings that the reservoir acts as a pesticide sink

or trap. This condition results in its discharges containing pesticide concentrations throughout the year which are significantly lower than those of the inflow during spring storm events but elevated above the levels present in the tributary during non-storm event periods.

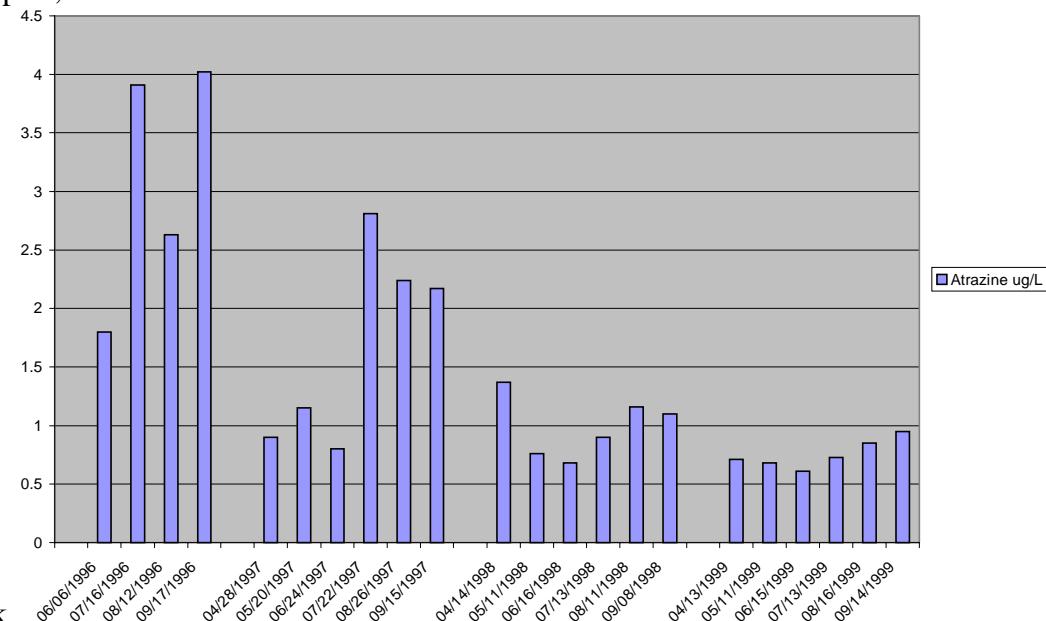
#### 4. Future Conditions.

The water quality of Milford Lake is good as evidenced by its excellent sport fishery of walleye and bass. With the continued detection of herbicides in the reservoir, seemingly the greatest potential threat to its water quality is pesticide loading derived from agriculture run-off from row crops within the watershed. In addition to impacting the reservoir's ecosystem, the pesticide loading has the potential of adversely affecting its water supply benefits, including those for the Milford Hatchery, which partially utilizes the lake for water supply.

#### 5. Recommendations.

With the current staffing and funding levels, the water quality surveillance program for Milford Lake will continue to be limited in 2000. Routine monthly pesticide sampling should continue to be conducted by Project personnel with logistic and analytical support from PM-PR-W. The District should enlist the other state and Federal agencies in developing a cooperative water quality monitoring and abatement program for Milford Lake and its watershed in 2001 similar to the one currently underway for Hillsdale Lake and the Big Bull watershed.

FIGURE 15: MI-1A



**TABLE 1: MILFORD LAKE DATA 1996-1999**

Station	Depth M	Date mm/dd/yy	Time hhmm	Atrazine ug/L	Alachlor ug/L	Metolachlor ug/L	Cyanazine ug/L	Ammonia mg/L	NO3/NO2 mg/L	TKN mg/L	TN mg/L	T - Phos mg/L	T - Ortho-P mg/L
MI - 24	0.1	06/06/1996	1030	7.36	1.15	4.87	0.92	0.02	1.1	0.5	1.62	0.35	0.38
	0.1	07/16/1996	1345	4.39	0.67	2.64	0.16						
	0.1	08/12/1996	1100	2	0.16	0.68	0.26						
	0.1	09/17/1996	1340	1.2	<0.1	0.2	<0.1						
Average				3.74	0.66	2.10	0.45	0.02	1.10	0.50	1.62	0.35	0.38
MI - 24	0.1	04/28/1997	1255	0.75	0.1	0.24	0.14	<0.02	0.24	1.5	1.74	0.19	0.06
	0.1	04/28/1997	1256										
	0.1	05/20/1997	0915	0.56	0.22	0.25	0.09	0.02	0.02	1.4	1.44	0.33	0.02
	0.1	06/24/1997	0925	14.5	2.29	10.05	0.31	0.25	0.64	3.4	4.29	0.44	0.21
	0.1	07/22/1997	1130	1.9	0.31	1.09	0.18	<0.02	0.02	1	1.02	0.1	0.05
	0.1	08/26/1997	1120	1.2	0.22	0.31	0.1	0.37	0.05	2.2	2.62	0.18	0.05
	0.1	09/15/1997	1110	0.93	0.09	0.34	0.06	0.09	0.07	0.4	0.56	0.17	0.09
Average				3.31	0.54	2.05	0.15	0.18	0.17	1.65	1.95	0.24	0.08
MI - 24	0.1	04/14/1998	1040	0.33	<0.05	0.1	0.05	0.05	1.18	1.6	2.83	0.25	0.16
	0.1	05/11/1998	1005	0.53	<0.05	0.17	<0.04	0.02	0.02	1.8	1.84	0.14	0.02
	0.1	06/16/1998	0945	3.62	0.41	2.68	0.45	0.09	0.04	1.8	1.93	0.32	0.04
	0.1	07/13/1998	1045	2.41	0.38	2.01	0.17	0.06	2.17	1.7	3.93	0.35	0.26
	0.1	08/11/1998	1035	0.59	0.05	0.19	0.05	0.09	0.03	2	2.12	0.51	0.05
	0.1	09/08/1998	1000	1.1	<0.05	0.14	0.06	0.04	0.07	1.3	1.41	0.17	0.09
Average				1.43	0.28	0.88	0.16	0.06	0.59	1.70	2.34	0.29	0.10
MI - 24	0.1	04/13/1999	1425	0.46	0.05	0.2	<0.04	U	U	1.64	1.64	0.21	0.02
	0.1	05/11/1999	1120	2.63	0.12	0.78	0.14	0.09	1.06	1.09	2.24	0.59	0.15
	0.1	06/15/1999	0930	3.35	0.72	1.69	0.11	U	U	1.84	1.84	0.33	0.04
	0.1	07/13/1999	1100	1.31	0.09	0.33	0.43	0.05	U	2.04	2.09	0.4	0.01
	0.1	08/16/1999	1235	1.26	0.08	0.17	0.1	0.02	0.03	2.11	2.16	0.36	0.06
	0.1	09/14/1999	0940	0.55	0.06	0.19	0.07	0.03	U	1.55	1.58	0.24	0.01
Average				1.59	0.19	0.56	0.17	0.05	0.55	1.71	1.93	0.36	0.05
MI - 1A	0.1	06/06/1996	0930	1.8	0.27	0.7	0.13	0.2	0.16	0.8	1.16	0.16	0.08
	0.1	07/16/1996	0930	3.91	0.44	1.82	0.25						
	0.1	08/12/1996	1155	2.63	0.39	2.24	0.21						
	0.1	09/17/1996	1425	4.02	0.32	1.95	0.19						
Average				3.09	0.36	1.68	0.20	0.20	0.16	0.80	1.16	0.16	0.08
MI - 1A	0.1	04/28/1997	0947	0.9	<0.1	0.3	<0.1	0.75	0.23	0.9	1.88	0.09	0.05
	0.1	05/20/1997	1040	1.15	0.1	0.38	0.09	0.16	0.17	1.2	1.53	0.16	0.06
	0.1	06/24/1997	1115	0.8	<0.1	<0.1	<0.1	0.32	0.33	1.1	1.75	0.08	0.08
	0.1	07/22/1997	1340	2.81	0.39	2.23	0.23	0.34	0.19	1.4	1.93	0.2	0.08
	0.1	08/26/1997	1210	2.24	0.42	2.08	0.11	0.04	0.26	0.7	1	0.26	0.15
	0.1	09/15/1997	1155	2.17	0.29	1.64	0.14	0.03	0.27	0.4	0.7	0.2	0.14
Average				1.68	0.30	1.33	0.14	0.27	0.24	0.95	1.47	0.17	0.09

Station	Depth M	Date mm/dd/yy	Time hhmm	Atrazine ug/L	Alachlor ug/L	Metolachlor ug/L	Cyanazine ug/L	Ammonia mg/L	NO3/NO2 mg/L	TKN mg/L	TN mg/L	T - Phos mg/L	T - Ortho-P mg/L
MI - 1A	0.1	04/14/1998	1130	1.37	0.07	0.48	0.11	0.28	0.16	1.3	1.74	0.11	0.07
	0.1	05/11/1998	1425	0.76	0.12	0.42	0.05	0.33	0.42	1.1	1.85	0.11	0.1
	0.1	06/16/1998	1050	0.68	0.08	0.29	0.06	0.09	0.61	0.8	1.5	0.44	0.09
	0.1	07/13/1998	1130	0.9	0.09	0.34	0.07	<0.02	0.56	0.7	1.26	0.2	0.01
	0.1	08/11/1998	1105	1.16	0.1	0.51	0.11	<0.02	0.42	1.5	1.92	0.3	0.11
	0.1	09/08/1998	1045	1.1	<0.05	0.62	0.08	0.29	0.31	0.6	1.2	0.36	0.28
Average				1.00	0.09	0.44	0.08	0.25	0.41	1.00	1.58	0.25	0.11
MI - 1A	0.1	04/13/1999	0810	0.71	<0.05	0.14	0.06	0.03	0.37	0.64	1.04	0.13	0.1
	0.1	05/11/1999	1204	0.68	<0.05	0.13	<0.04	0.43	0.3	0.98	1.71	0.49	0.09
	0.1	06/15/1999	1015	0.61	0.28	2.13	<0.04	U	1.32	0.51	1.83	0.18	0.14
	0.1	07/13/1999	1145	0.73	0.51	3.16	0.22	0.04	1.02	0.38	1.44	0.18	0.14
	0.1	08/16/1999	1255	0.85	0.22	1.98	0.06	U	0.89	0.51	1.4	0.18	0.16
	0.1	09/14/1999	1110	0.95	0.32	2.19	0.05	0.09	0.79	0.55	1.43	0.16	0.18
Average				0.76	0.33	1.62	0.10	0.15	0.78	0.60	1.48	0.22	0.14
MI - 1	0.1	06/06/1996	1345	2.32	0.38	1.4	0.2	0.09	0.16	0.7	0.95	0.28	0.04
	0.1	07/16/1996	0830	5.1	<0.1	2.9	<0.1						
	0.1	08/12/1996	0845	2.79	0.4	2.5	0.28						
	0.1	09/17/1996	1148	2.51	0.34	2.24	0.2						
Average				3.18	0.37	2.26	0.23	0.09	0.16	0.70	0.95	0.28	0.04
MI - 1	0.1	04/28/1997	1022	0.95	0.17	0.33	0.11	0.8	0.22	0.8	1.82	0.09	0.04
	0.1	05/20/1997	1005	3	<0.1	0.3	<0.1	0.26	0.15	1.1	1.51	0.16	0.05
	0.1	06/24/1997	1045	2.53	0.72	1.54	0.16	0.14	0.19	0.9	1.23	0.11	0.1
	0.1	07/22/1997	0850	3.59	0.62	2.53	0.3	<0.02	0.18	1.1	1.28	0.08	0.06
	0.1	08/26/1997	0905	2	0.46	1.82	0.13	0.02	0.18	0.9	1.1	0.39	0.12
	0.1	09/15/1997	0825	1.92	0.21	1.57	0.13	0.09	0.32	0.5	0.91	0.26	0.15
Average				2.33	0.44	1.35	0.17	0.26	0.21	0.88	1.31	0.18	0.09
MI - 1	0.1	04/14/1998	0827	1.22	0.08	0.56	0.1	0.28	0.15	1	1.43	0.09	0.07
	0.1	05/11/1998	1049	0.71	<0.05	0.33	0.05	0.18	0.45	1	1.63	0.09	0.08
	0.1	06/16/1998	0754	0.85	0.1	0.34	0.07	0.1	0.59	0.9	1.59	0.28	0.09
	0.1	07/13/1998	0909	1.07	0.09	0.48	0.09	0.14	0.2	0.9	1.24	0.12	0.02
	0.1	08/11/1998	0815	1.26	0.1	0.53	0.1	<0.02	0.42	1.4	1.82	0.27	0.12
	0.1	09/08/1998	0719	1.64	0.05	0.38	0.09	<0.02	0.15	0.8	0.95	0.18	0.11
Average				1.13	0.08	0.44	0.08	0.18	0.33	1.00	1.44	0.17	0.08
MI - 1	0.1	04/13/1999	0822	0.16	<0.05	<0.05	<0.04	0.03	0.39	0.51	0.93	0.1	0.07
	0.1	05/11/1999	0911	0.67	<0.05	0.17	0.05	0.34	0.3	0.86	1.5	0.47	0.09
	0.1	06/15/1999	0725	0.51	0.35	2.65	<0.04	U	1.03	0.55	1.58	0.18	0.15
	0.1	07/13/1999	0740	0.76	0.46	3.05	0.23	0.02	1.07	0.35	1.44	0.18	0.13
	0.1	08/16/1999	1040	0.93	0.39	2.2	0.07	U	0.9	0.47	1.37	0.16	0.16
	0.1	09/14/1999	0820	1.04	0.39	2.48	0.08	0.11	0.8	0.64	1.55	0.15	0.18
Average				0.68	0.40	2.11	0.11	0.13	0.75	0.56	1.40	0.21	0.13

Station	Depth M	Date mm/dd/yy	Time hhmm	Atrazine ug/L	Alachlor ug/L	Metolachlor ug/L	Cyanazine ug/L	Ammonia mg/L	NO3/NO2 mg/L	TKN mg/L	TN mg/L	T - Phos mg/L	T - Ortho-P mg/L
MI - 1	20	06/06/1996	1405	1.73	0.4	1	0.16	0.16	0.16	0.9	1.22	0.48	0.05
	20	07/16/1996	0850	4.14	0.37	2.21	0.19						
	20	08/12/1996	0905	2.84	0.35	2.19	0.22						
	20	09/17/1996	1208	2.2	0.3	1.87	0.19						
Average				2.73	0.36	1.82	0.19	0.16	0.16	0.90	1.22	0.48	0.05
MI - 1	22	04/28/1997	1044	0.87	0.18	0.45	0.11	0.02	0.25	0.7	0.97	0.1	0.05
	21	05/20/1997	1026	0.79	0.21	0.32	0.1	0.19	0.16	1.5	1.85	0.14	0.08
	22	06/24/1997	1107	2.34	0.66	1.29	0.13	0.33	0.2	1.3	1.83	0.17	0.15
	21	07/22/1997	0911	2.68	0.38	2.15	0.24	0.44	0.23	1.7	2.37	0.24	0.09
	22	08/26/1997	0927	2.04	0.47	1.88	0.17	0.37	0.23	2.1	2.7	0.37	0.12
	22	09/15/1997	0847	2.28	0.3	1.78	0.17	0.07	0.31	0.6	0.98	0.25	0.16
Average				1.83	0.37	1.31	0.15	0.24	0.23	1.32	1.78	0.21	0.11
MI - 1	23	04/14/1998	0850	1.22	0.08	0.16	0.13	0.26	0.14	1.1	1.5	0.07	0.07
	21	05/11/1998	1110	0.75	0.11	0.34	0.05	0.45	0.39	1.7	2.54	0.14	0.1
	21	06/16/1998	0815	0.8	0.1	0.31	0.09	0.11	0.58	1.2	1.89	0.13	0.09
	21	07/13/1998	0930	0.83	0.13	0.35	0.08	0.22	0.6	1.5	2.32	0.25	0.04
	21	08/11/1998	0836	1.21	0.09	0.47	0.1	0.04	0.49	2.4	2.93	0.31	0.11
	21	09/08/1998	0740	2.35	0.13	0.5	0.11	0.04	0.46	0.9	1.4	0.25	0.15
Average				1.19	0.11	0.36	0.09	0.19	0.44	1.47	2.10	0.19	0.09
MI - 1	20	04/13/1999	0842	0.67	<0.05	0.13	0.07	U	0.37	0.71	1.08	0.09	0.08
	22	05/11/1999	0933	0.72	<0.05	0.16	0.04	0.39	0.29	1.69	2.37	0.61	0.08
	21	06/15/1999	0746	0.76	0.13	0.9	<0.04	U	2.18	0.66	2.84	0.62	0.09
	22	07/13/1999	0802	0.72	0.51	2.84	0.24	0.1	1.02	0.8	1.92	0.23	0.13
	21	08/16/1999	1101	0.79	0.38	2.16	0.05	0.04	0.88	0.87	1.79	0.19	0.17
	21	09/14/1999	0841	1	0.34	2.4	0.07	0.06	0.8	1.06	1.92	0.19	0.18
Average				0.78	0.34	1.43	0.09	0.15	0.92	0.97	1.99	0.32	0.12
MI - 3	0.1	07/17/1996	0650	3.66	0.41	2.25	0.23						
	0.1	08/12/1996	0930	2.93	0.34	2.29	0.22						
	0.1	09/17/1996	1223	2.32	0.26	1.69	0.2						
Average				2.97	0.34	2.08	0.22						
MI - 3	0.1	04/28/1997	1123	0.9	0.15	0.25	0.1	<0.02	0.04	0.9	0.94	0.12	0.03
	0.1	05/20/1997	0806	1.23	0.17	0.37	0.12	0.11	0.08	1.5	1.69	0.1	0.08
	0.1	06/24/1997	1010	4	1.3	2.3	0.27	0.1	0.04	1	1.14	0.1	0.07
	0.1	07/22/1997	1030	3.25	0.47	2.8	0.24	0.07	0.02	1.6	1.69	0.09	0.05
	0.1	08/26/1997	1000	4.12	0.4	1.9	0.15	0.05	0.2	1	1.25	0.23	0.13
	0.1	09/15/1997	0950	1.94	0.25	1.47	0.12	0.02	0.43	0.9	1.35	0.18	0.12
Average				2.57	0.46	1.52	0.17	0.07	0.14	1.15	1.34	0.14	0.08

Station	Depth M	Date mm/dd/yy	Time hhmm	Atrazine ug/L	Alachlor ug/L	Metolachlor ug/L	Cyanazine ug/L	Ammonia mg/L	NO3/NO2 mg/L	TKN mg/L	TN mg/L	T - Phos mg/L	T - Ortho-P mg/L
MI - 3	0.1	04/14/1998	0930	0.68	0.07	0.33	0.07	0.37	0.42	1.2	1.99	0.25	0.09
	0.1	05/11/1998	1025	0.64	0.12	0.26	0.05	0.02	0.21	1.4	1.63	0.08	0.02
	0.1	06/16/1998	0837	0.81	0.08	0.47	0.05	0.06	0.6	0.5	1.16	0.09	0.09
	0.1	07/13/1998	1000	1.34	0.18	0.71	0.11	<0.02	0.02	1.4	1.42	0.44	0.1
	0.1	08/11/1998	0905	1.47	0.07	0.61	0.11	<0.02	0.61	1.4	2.01	0.32	0.14
	0.1	09/08/1998	0815	1.69	0.1	0.48	0.11	0.03	0.29	0.8	1.12	0.39	0.18
Average				1.11	0.10	0.48	0.08	0.12	0.36	1.12	1.56	0.26	0.10
MI - 3	0.1	04/13/1999	1530	0.61	<0.05	0.12	<0.04	U	0.22	0.92	1.14	0.1	0.06
	0.1	05/11/1999	0942	0.86	0.07	0.24	0.05	0.43	0.41	0.8	1.64	0.4	0.1
	0.1	06/15/1999	0800	0.5	0.4	3.36	<0.04	U	1.56	0.54	2.1	0.19	0.16
	0.1	07/13/1999	0820	1.28	0.52	3.01	0.36	0.05	1.02	0.53	1.6	0.26	0.14
	0.1	08/16/1999	1115					0.03	0.77	0.62	1.42	0.19	0.17
	0.1	09/14/1999	1050	0.96	0.3	2.28	0.08	U	0.6	0.6	1.2	0.18	0.18
Average				0.84	0.32	1.80	0.16	0.17	0.76	0.67	1.52	0.22	0.14
MI - 3	12.5	07/17/1996	0703	4.02	0.35	2.41	0.22						
	12.5	08/12/1996	0943	2.55	0.31	2.46	0.31						
	12.5	09/17/1996	1236	2.55	0.35	1.87	0.23						
Average				3.04	0.34	2.25	0.25						
MI - 3	14	04/28/1997	1137	0.84	0.14	0.41	0.12	0.11	0.25	1.6	1.96	0.16	0.08
	12	05/20/1997	0818	3.13	0.12	0.38	0.1	0.02	0.11	1.4	1.53	0.08	0.07
	14	06/24/1997	1024	4.27	1.09	2.5	0.22	0.33	0.05	1.3	1.68	0.11	0.06
	12	07/22/1997	1042	3.38	0.47	2.56	0.23	0.06	0.45	1.9	2.41	0.16	0.11
	13	08/26/1997	1013	2.22	0.37	1.95	0.12	0.08	0.25	1.6	1.93	0.19	0.11
	14	09/15/1997	1004	2.17	<0.05	1.43	<0.04						
Average				2.67	0.44	1.54	0.16	0.12	0.22	1.56	1.90	0.14	0.09
MI - 3	15	04/14/1998	0945	0.8	<0.05	0.21	0.08	0.38	0.62	1.2	2.2	0.35	0.13
	12	05/11/1998	1037	0.57	0.08	0.23	0.04	0.02	0.23	0.9	1.15	0.09	0.03
	13	06/16/1998	0850	1.02	0.13	0.63	0.09	0.14	0.62	1.3	2.06	0.14	0.1
	13	07/13/1998	1013	1.05	0.1	0.48	0.09	0.32	0.35	1.8	2.47	0.54	0.02
	13	08/11/1998	0918	1.38	0.1	0.78	0.09	0.03	0.79	1.8	2.62	0.51	0.11
	13	09/08/1998	0828	1.57	<0.05	0.63	0.07	0.04	0.55	0.9	1.49	0.3	0.22
Average				1.07	0.10	0.49	0.08	0.16	0.53	1.32	2.00	0.32	0.10
MI-3	12	04/13/1999	1542	0.68	0.06	0.18	0.05	U	0.22	0.95	1.17	0.09	0.05
	14	05/11/1999	0956	0.98	0.05	0.28	0.06	0.53	0.39	0.84	1.76	0.42	0.1
	13	06/15/1999	0813	0.46	0.31	2.13	<0.04	0.13	0.51	4.2	4.84	1.43	0.08
	14	07/13/1999	0834	1.2	0.52	3.01	0.36	0.06	0.96	0.86	1.88	0.24	0.13
	13	08/16/1999	1128	0.92	0.4	2.16	0.07	0.02	0.75	1.12	1.89	0.2	0.17
	13	09/14/1999	1103	1.01	0.31	2.3	0.07	U	0.6	0.71	1.31	0.19	0.17
Average				0.88	0.28	1.68	0.12	0.19	0.57	1.45	2.14	0.43	0.12

Station	Depth M	Date mm/dd/yy	Time hhmm	Atrazine ug/L	Alachlor ug/L	Metolachlor ug/L	Cyanazine ug/L	Ammonia mg/L	NO3/NO2 mg/L	TKN mg/L	TN mg/L	T - Phos mg/L	T - Ortho-P mg/L
MI - 5	0.1	06/06/1996	1215	7.25	1.39	4.41	0.71	0.33	0.5	0.7	1.53	0.44	0.03
	0.1	07/17/1996	0715	3.73	0.66	2.73	0.2						
	0.1	08/12/1996	1015	2.42	0.17	0.86	0.31						
	0.1	09/17/1996	1258	1.84	0.13	0.62	0.12						
Average				3.81	0.59	2.16	0.34	0.33	0.50	0.70	1.53	0.44	0.03
MI - 5	0.1	04/28/1997	1158	0.71	0.07	0.14	0.14	<0.02	0.01	1.4	1.41	0.12	0.04
	0.1	05/20/1997	0840	0.97	0.11	0.24	0.08	0.22	0.01	1.7	1.93	0.07	0.03
	0.1	06/24/1997	0900	4.81	1.07	3.06	0.25	0.45	0.05	2	2.5	0.27	0.17
	0.1	07/22/1997	1100	3.06	0.67	3.03	0.26	0.03	0.2	3.8	4.03	0.28	0.11
	0.1	08/26/1997	1055	1.88	0.3	0.57	0.09	0.38	0.24	1.6	2.22	0.2	0.16
	0.1	09/15/1997	1025	1.87	<0.05	0.3	<0.04	0.03	0.07	1.1	1.2	0.2	0.12
Average				2.22	0.44	1.22	0.16	0.22	0.10	1.93	2.22	0.19	0.11
MI - 5	0.1	04/14/1998	1008	0.29	0.07	0.23	<0.04	0.17	1.16	1.3	2.63	0.19	0.16
	0.1	05/11/1998	0925	0.35	0.05	0.13	<0.04	0.02	0.03	1.5	1.55	0.18	0.04
	0.1	06/16/1998	0915	15.9	1.16	9.2	0.31	0.49	1.1	2.4	3.99	0.25	0.16
	0.1	07/13/1998	1020	2.62	0.26	1.85	0.15	0.07	0.49	2.1	2.66	0.18	0.11
	0.1	08/11/1998	0955	1.19	0.14	0.9	0.1	0.25	0.69	1.9	2.84	0.61	0.2
	0.1	09/08/1998	0815	2.05	<0.05	0.27	0.12	0.3	0.12	1.3	1.72	0.44	0.23
Average				3.73	0.34	2.10	0.17	0.22	0.60	1.75	2.57	0.31	0.15
MI - 5	0.1	04/13/1999	1500	0.23	<0.05	0.08	<0.04	U	U	2.13	2.13	0.38	0.05
	0.1	05/11/1999	1020	3.2	0.17	1.08	0.19	0.12	0.82	1.23	2.17	0.57	0.16
	0.1	06/15/1999	0900	3.17	0.8	4.51	0.12	0.07	0.8	1.47	2.34	0.4	0.17
	0.1	07/13/1999	1030	1.4	0.6	3.18	0.31	0.12	1.1	1.26	2.48	0.3	0.16
	0.1	08/16/1999	1150	1.37	0.2	0.84	0.09	0.23	0.47	1.54	2.24	0.35	0.18
	0.1	09/14/1999	1000	1.01	0.25	1.78	0.07	0.07	0.44	0.88	1.39	0.25	0.2
Average				1.73	0.40	1.91	0.16	0.12	0.73	1.42	2.13	0.38	0.15
MI - 5	5	06/06/1996	1220	7.65	1.51	5	0.75	0.27	0.52	0.4	1.19	0.28	0.3
	5	07/17/1996	0730	4.75	0.65	2.72	0.22						
	5	08/12/1996	1020	2.43	0.23	0.68	0.27						
	5	09/17/1996	1303	2.25	0.19	0.8	0.25						
Average				4.27	0.65	2.30	0.37	0.27	0.52	0.40	1.19	0.28	0.30
MI - 5	6	04/28/1997	1204	0.87	0.15	0.3	0.13	0.11	0.15	2.4	2.66	0.22	0.07
	4	05/20/1997	0844	1.3	0.13	0.4	0.11	0.22	0.03	1.7	1.95	0.16	0.1
	6	06/24/1997	0906	6.45	1.28	2.9	0.32	0.08	0.05	3.1	3.23	0.36	0.18
	5	07/22/1997	1105	3.13	0.58	2.12	0.25	<0.02	0.15	3	3.15	0.31	0.25
	5	08/26/1997	1100	2.07	0.29	0.92	0.11	0.36	0.29	1.8	2.45	0.26	0.12
	6	09/15/1997	1031	1.62	0.16	0.59	0.11	0.14	0.07	0.5	0.71	0.22	0.14
Average				2.57	0.43	1.21	0.17	0.18	0.12	2.08	2.36	0.26	0.14

Station	Depth M	Date mm/dd/yy	Time hhmm	Atrazine ug/L	Alachlor ug/L	Metolachlor ug/L	Cyanazine ug/L	Ammonia mg/L	NO3/NO2 mg/L	TKN mg/L	TN mg/L	T - Phos mg/L	T - Ortho-P mg/L
MI - 5	7	04/14/1998	1015	0.36	<0.05	0.24	0.05	0.19	1.19	1.3	2.68	0.32	
	5	05/11/1998	0930	0.37	<0.05	0.15	<0.04	0.02	0.03	3.5	3.55	0.42	0.04
	6	06/16/1998	0921	14	1.08	4.94	0.29	0.62	1.05	2.5	4.17	0.32	0.22
	6	07/13/1998	1026	3.13	0.45	2.22	0.19	0.3	0.89	2.7	3.89	0.38	0.01
	6	08/11/1998	1001	1.31	0.13	0.83	0.09	0.27	0.67	0.3	1.24	0.59	0.2
	6	09/08/1998	0821	1.98	<0.05	0.21	0.11	0.3	0.05	2.2	2.55	0.26	0.21
Average				3.53	0.55	1.43	0.15	0.28	0.65	2.08	3.01	0.38	0.14
MI - 5	5	04/13/1999	1505	0.34	< 0.05	0.12	< 0.04	U	0.04	1.85	1.89	0.38	0.05
	6	05/11/1999	1026	3.38	0.17	1.08	0.22	0.08	0.81	1.33	2.22	0.57	0.16
	6	06/15/1999	0906	3.46	0.85	4.61	0.11	0.1	0.96	2.09	3.15	0.48	0.15
	7	07/13/1999	1037	1.5	0.65	3.12	0.36	0.05	1.08	0.67	1.8	0.27	0.16
	6	08/16/1999	1156	1.65	0.16	0.5	0.1	0.19	0.42	2.24	2.85	0.38	0.2
	6	09/14/1999	1006	0.82	0.15	1.04	0.06	0.27	0.22	1.67	2.16	0.33	0.18
Average				1.86	0.40	1.75	0.17	0.14	0.59	1.64	2.35	0.40	0.15